NNIS PNEUMONIA FLOW DIAGRAM

NNID # _____ Infection ID# _____-_____ Infection date ____/____/_____

Instructions: Complete form only if x-ray criteria are met

X-Ray

Patient **with underlying diseases**[1,2] has **2 or more serial X-rays** with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Patient **without underlying diseases**[1,2] has **1 or more serial X-rays** with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Signs and Symptoms

At least **one** of the following:

- ❑ Fever (> 38° C/100.4° F) with no other cause
- ❑ Leukopenia (< 4,000 WBC/mm³) or leukocytosis (≥ 12,000 WBC/mm³)
- ❑ Altered mental status with no other cause, in ≥ 70 y.o.

At least **one** of the following in an **immunocompromised patient**[13]:

- ❑ Fever (> 38° C/100.4° F) with no other cause
- ❑ Altered mental status with no other cause, in ≥ 70 y.o.
- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., $PaO_2/FiO_2 \leq 240$],[7] ↑ O_2 req, or ↑ ventilation demand)
- ❑ Hemoptysis
- ❑ Pleuritic chest pain

At least **two** of the following:

- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., $PaO_2/FiO_2 \leq 240$],[7] ↑ O_2 req, or ↑ ventilation demand)

At least **one** of the following:

- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., $PaO_2/FiO_2 \leq 240$],[7] ↑ O_2 req, or ↑ ventilation demand)

Immunocompromised

Immunocompromised

Laboratory

At least **one** of the following:

- ❑ Positive blood culture not related to another infection[8]
- ❑ Positive pleural fluid culture
- ❑ Positive quantitative culture[9] from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing)
- ❑ ≥ 5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam
- ❑ Histopathologic exam shows **one** of the following:
  - Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli
  - Positive quantitative culture[9] of lung parenchyma
  - Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae

At least **one** of the following[10-12]:

- ❑ Positive culture of virus or *Chlamydia* from respiratory secretions
- ❑ Positive detection of viral antigen or antibody from respiratory secretions (e.g., EIA, FAMA, shell vial assay, PCR)
- ❑ 4-fold rise in paired sera (IgG) for pathogen (e.g., Influenza viruses, *Chlamydia*)
- ❑ Positive PCR for *Chlamydia* or *Mycoplasma*
- ❑ Positive micro-IF test for *Chlamydia*
- ❑ Positive culture or micro-IF of *Legionella* spp from respiratory secretions or tissue
- ❑ Detection of *Legionella pneumophila* serogroup 1 antigens in urine by RIA or EIA
- ❑ 4-fold rise in *L. pneumophila* antibody titer to ≥ 1:128 in paired acute and convalescent sera by indirect IFA

At least **one** of following:

- ❑ Matching positive blood and sputum cultures with *Candida* spp[14,15]
- ❑ Evidence of fungi or *Pneumocytis carinii* from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing) from **one** of the following:
  - Direct microscopic exam
  - Positive culture of fungi

Immunocompromised

Immunocompromised

❑ **PNU1: Clinically defined pneumonia**

❑ **PNU2: Pneumonia with common bacterial or filamentous fungal pathogens and specific lab findings**

❑ **PNU2: Pneumonia with viral, *Legionella, Chlamydia, Mycoplasma,* and other uncommon pathogens and specific lab findings**

❑ **PNU3: Pneumonia in immunocompromised patients**

Abbreviations:

BAL – bronchoalveolar lavage

EIA – enzyme immunoassay

FAMA – fluorescent-antibody staining of membrane antigen

IFA – immunofluorescent antibody

LRT – lower respiratory tract

PCR – polymerase chain reaction

PMN – polymorphonuclear neutrophil

RIA – radioimmunoassay

Reporting Instructions:

- Report concurrent lower respiratory tract infection (e.g., abscess or empyema) and pneumonia with the same organism(s) as pneumonia.
- Report lung abscess or empyema without pneumonia as LUNG.
- Report acute bronchitis, tracheitis, tracheobronchitis, or bronchiolitis without pneumonia as BRON.

Comments:

1. Occasionally, in nonventilated patients, the diagnosis of nosocomial pneumonia may be quite clear on the basis of symptoms, signs, and a single definitive chest radiograph. However, in patients with other pulmonary or cardiac disease (for example, congestive heart failure, interstitial lung disease, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease) or smoke or inhalation pulmonary injury, the diagnosis of pneumonia may be particularly difficult. Other non-infectious conditions (for example, pulmonary edema from compensated congestive heart failure) may simulate the presentation of pneumonia. In these more difficult cases, serial chest radiographs must be examined to help separate infectious from non-infectious pulmonary processes. To help confirm difficult cases, it may be useful to review radiographs on the day of diagnosis, 3 days prior to the diagnosis, and on days 2 and 7 after the diagnosis. Pneumonia may have rapid onset and progression, but it does not resolve quickly. Radiographic changes of pneumonia persist for several weeks. As a result, rapid radiographic resolution suggests that the patient does not have pneumonia, but rather a non-infectious process such as atelectasis or congestive heart failure.
2. Note that there are many ways of describing the radiographic appearance of pneumonia. Examples include, but are not limited to, "air-space disease," "focal opacification," and "patchy areas of increased density." Although perhaps not specifically delineated as "pneumonia" by the radiologist, in the appropriate clinical setting these alternative descriptive wordings should be seriously considered as potentially positive findings.
3. Purulent sputum is defined as secretions from the lungs, bronchi, or trachea that contain $\geq$25 neutrophils and $\leq$10 squamous epithelial cells per low power field (x100). If your laboratory reports these data qualitatively (e.g., "many WBCs" or "few squames"), be sure their descriptors match this definition of purulent sputum. This laboratory confirmation is required since written clinical descriptions of purulence are highly variable.
4. A single notation of either purulent sputum or change in character of the sputum is not meaningful; repeated notations over a 24 hour period would be more indicative of the onset of an infectious process. Change in character of sputum refers to the color, consistency, odor and quantity.
5. In adults, tachypnea is defined as respiration rate >25 breaths per minute. Tachypnea is defined as >75 breaths per minute in premature infants born at <37 weeks gestation and until the 40th week; >60 breaths per minute in patients <2 months old; >50 breaths per minute in patients 2-12 months old; and >30 breaths per minute in children >1 year old.
6. Rales may be described as "crackles."
7. This measure of arterial oxygenation is defined as the ratio of the arterial tension (PaO_2) to the inspiratory fraction of oxygen (FiO_2)
8. Care must be taken to determine the etiology of pneumonia in a patient with positive blood cultures and radiographic evidence of pneumonia, especially if the patient has invasive devices in place such as intravascular lines or an indwelling urinary catheter. In general, in an immunocompetent patient, blood cultures positive for coagulase negative staphylococci, common skin contaminants, and yeasts will not be the etiologic agent of the pneumonia.
9. Refer to Table 1 for threshold values of bacteria from cultured specimens. An endotracheal aspirate is **not** a minimally contaminated specimen. Therefore, an endotracheal aspirate does not meet the laboratory criteria.
10. Once laboratory-confirmed cases of pneumonia due to respiratory syncytial virus (RSV), adenovirus, or influenza virus have been identified in a hospital, clinicians= presumptive diagnosis of these pathogens in subsequent cases with similar clinical signs and symptoms is an acceptable criterion for presence of nosocomial infection.
11. Scant or watery sputum is commonly seen in adults with pneumonia due to viruses and mycoplasma although sometimes the sputum may be mucopurulent. In infants, pneumonia due to RSV or influenza yields copious sputum. Patients, except premature infants, with viral or mycoplasmal pneumonia may exhibit few signs or symptoms, even when significant infiltrates are present on radiographic exam.
12. Few bacteria may be seen on stains of respiratory secretions from patients with pneumonia due to *Legionella* spp, mycoplasma, or viruses.
13. Immunocompromised patients include those with neutropenia (absolute neutrophil count <500/mm^3), leukemia, lymphoma, HIV with CD4 count <200, or splenectomy; those who are in their transplant hospital stay; and those who are on cytotoxic chemotherapy, high dose steroids or other immunosuppressives daily for >2 week(e.g., >40mg of prednisone or its equivalent [>160mg hydrocortisone, >32mg methylprednisolone, >6mg dexamethasone, >200mg cortisone].
14. Blood and sputum specimens must be collected within 48 hours of each other.
15. Semiquantitative or nonquantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage are acceptable. If quantitative culture results are available, refer to algorithms that include such specific laboratory findings.